HALTON REGION LANDFILL TECHNICAL STUDY
AIR QUALITY ANALYSIS
SITE D AND F ADDENDA

EXHIBIT H-29A

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OPERATION OF THE ENVIRONMENTAL AIR STANDARDS SETTING COMMITTEE (EASSC)

The development of environmental air standards setting procedures has evolved over the past several years. Experience has shown the necessity for the documentation of the data and body of opinion supporting the recommendations for the ambient air quality criteria and point of impingement standards chosen.

The EASSC is primarily concerned with documentation and evaluation leading to the recommendations for ambient air criteria, standards, guidelines and provisional guidelines. To assist this interdisciplinary committee, two subcommittees have been formed to handle the preparation of source and ambient air testing procedures for each air contaminant under consideration, i.e. the The Source Testing Subcommittee and the Subcommittee on Ambient Mearurements. The directives under which the subcommittees operate come primarily from the EASSC.

The following is an outline of the composition, responsibilities and current procedures of the EASSC in developing ambient air quality criteria, point of impingement standards, guidelines and provisional guidelines.

Composition of the EASSC	Responsibilities
Emission Technology and Regulation Development Section, Air Resources Branch, Ministry of the Environment, (MOE).	Two representatives, one to act as Chairman, and the other to act as general and recording secretary and as coordinator.
Special Studies and Services Branch, Ministry of Labor, (MOL).	One or more representatives as required, to advise the EASSC on all health aspects.
Phytotoxicology Section Air Resources Branch, MOE.	One representative to advise on effects on vegetation. Also responsible for input from the agricultural community and universities with respect to impact on animals and agriculture.
Air Quality and Meteorology Section, Air Resources Branch, MOE.	One representative to advise on the air transport characteristics of the contaminant and on air quality data.

Environmental Approvals Branch, MOE.	One representative responsible for obtaining input from the field and initial input from industry, or industry association, and the Approvals Branch.
Water Resources Branch,	One representative to assess the possible impact of the contaminant under conside-ration on aquatic life, also responsible for the interests of the Ministry of Natural Resources.
Policy and Planning Branch	One representative to advise on the economic consequences or cost/benefit aspects of decisions.
Hazardous Contaminants Coordination Branch	One representative to advise on intergovernmental and on multimedia aspects.
Waste Management Branch	One representative to advise on waste management aspects.

This is a permanent committee, and as far as possible representation on it should not be changed. It is recognized however, that alternate representatives will have to be used in case of illness or vacations.

The committee shall be free to call upon technical experts as needed. These experts will act as observers at any committee meeting where their presence is required.

The minutes of the committee represent the original records with respect to the setting of air standards and guidelines. The EASSC publishes its output in the form of a periodically updated list of standards and guidelines. The current (as of March 9 1987) list of Ambient Air Quality Criteria, Standards, Tentative Design Standards, Guidelines and Provisional Guidelines for Air Contaminants, is attached.

24/3/87/gn

List of Ambient Air Quality Criteria, Standards, Tentative Design Standards, Guidelines, and Provisional Guidelines as of 9, March 1987

	point of impingement 1/2 hour ave POI	ambient air qual criteria AAQC	limiting effect LE	status of standard ST
Contaminant	.5h Av	24h Av		
Acetic Acid	2500	2500	O	S
Acetylene	56000	56000	O	S
Acetone	48000	48000	O	S
Acrylamide	45	15	H	S
Acrylonitrile *	2200	750	H	S
Acrylonitrile	300	100	H	TS
n-alkyltoluene sulphonamide	100	120	T	PG
Alpha Naphthol	100	100	H	G
Aluminum Oxide	100	120	T	PG
Ammonia	3600	3600	O	S
Ammonium chloride	100	100	T	PG
Antimony	75	25	H	S
Arsenic *	75	25	H	S
Arsenic *	15	5	H	TS
Arsenic	1	.3	H	PG
Arsine	10	5	H	S
Asbestos	5 #	0.04 9	H	G
Barium-total water soluble	30	10	H	G
Benzene	10000	3300	H	S
Benzo(a)pyrene	3.3 16 ss	0.3 16,6 as 1.1 16,ss 0.22 16,6,ss	H	PG

Benzothiazole	200	70		H	PG
Benzoyl Chloride	350	125		C,H	PG
Beryllium	0.03	0.01		H	S
Biphenyl	60	60	1	O	G
Boron Tribromide	100	35		C	S
Boron Trichloride	100	35		C	S
Boron Trifluoride	5	2		V	S
Boron	100	100		T	S
Bromacil	30	10		H	G
Bromine	70	20		H	S
n Butanol		15000	1	I	PG
	2278	3100	18	O	PG
		770		O	PG
		147	6	O	PG
n-Butyl Acetate*	15000	15000		I	PG
n Butyl Acetate		15000	1	H	PG
	735	1000	18	O	PG
		248		O	PG
		47	6	O	PG
Butyl Acrylate	100	100		T	G
Butyl Stearate	100	14000		T	G
Cadmium	5	2		H	S
Calcium Carbide	20	10		W	PG
Calcium Cyanide @@	100	100		T	PG
Calcium Hydroxide	27	13.5		C	S
Calcium Oxide	20	10		C	S
Captan	75	25		H	PG
Carbon Black	25	10		S	S
Carbon Disulphide	330	330		O	S
Carbon Monoxide	6000	36200	1	H	S

		15700 2	Z	S
Carbon Tetrachloride	20000	7000	H	S
Carbon Tetrachloride	1800	600	H	G
Cellosolve Acetate	100	5000	T	G
Chloramben	100	120	T	PG
Chlordane	15	5	H	G
Chlorinated Dibenzo Dioxins, CDDs	450 17	30 17,6	H	PG
Mixtures of Chlorinated Dibenzo Dioxins and Chlorinated Dibenzo Furans, CDFs				
x/450pg + y/450(50)pg = 1		x/30pg + y/30(50)pg =1 (annual average)	H	PG
x=concentration (pg/m) of CDDs in air				
y=concentration (pg/m) of CDFs in air pg=picogram=10-12g,				
Chlorine	300	150	H,V	S
Chlorine Dioxide	85	30	H	S
Chloroform	1500	500	H	G
Chromium *	30	10	H	S
Chromium (Di, Tri, and Hexavalent forms)	5	1.5	H	PG
Coal Pitch Volatiles	3	1	H	PG
(soluble fraction)		0.2 6		PG
Copper	100	50	H	S
Cresols	230	75	H	S
Cyclo Sol 63	25000	5000	H	PG
Cyclohexane	300000	100000	H	G
Decaborane	50	25	H	S
Decene-1	180000	60000	H	PG
Detergent Enzyme *	1	0.3	H	S

(Subtilisin)

[tergent Enzyme	0.20	0.06	H	TS
Diazinon	9	3	H	G
[.borane	20	10	H	S
[butyltin Dilaurate	100	30	H	G
Dicapryl Phthalate	100	500	T	S
[isobutyl Ketone		3500	H	PG
	470	649 18	O	PG
		159	O	PG
		30 6	O	PG
Difluorodichloromethane	1.5M	500000	H	G
Freon 12)				
Dimethyl Disulphide	40	40 1	O	S
[methyl Ether	2100	2100	O	G
D methyl Sulphide	30	30 1	O	S
Dioctyl Phthalate	100	500	T	S
[decyl Benzene	100	100	T	PG
Sulphonic Acid				
[operidol	3	1	H	PG
D stfall	8000 @	7.0 3,4	S	S
Ethyl Acetate	19000	19000 1	O	S
E hyl Acrylate	4.5	4.5 1	O	S
Ethyl Alcohol	19000	19000 1	O	G
E hyl Benzene	4000	4000 1	O	S
E+hyl Ether	30000	30000	O,H	TS
Ethyl-3-ethoxy propionate	147	200 18	O	PG
		50	O	PG
		6500	H	PG
		9.5 6	O	PG
2-Ethyl Hexanol	600	600 1	O	G

Ethylene	160	40		V	TS
Ethylene Dichloride	1200	400		H	PG
Ethylene Glycol Dinitrate	10	3		H	G
Ethylene Glycol Butyl Ether		2400		H	PG
(Butyl Cellosolve)	350	500	18	O	PG
Ethylene Glycol		3250		H	PG
Butyl Ether Acetate	500	700	18	O	PG
(Butyl Cellosolve Acetate)					
Ethylene Glycol		380		H	PG
Ethyl Ether	800	1100	18	O	PG
(Cellosolve)					
Ethylene Glycol		540		H	PG
Ethyl Ether Acetate	220	300	18	O	PG
(Cellosolve Acetate)					
Ethylene Oxide *	28500	9500		H	S
Ethylene Oxide	15	5		H	PG
Ethylenediaminetetra-	100	120		T	PG
acetic Acid					
Fentanyl Citrate	0.06	0.02		H	PG
Ferric Oxide	75	25		S	S
Fluoridation T,GS		40	4,15	V	G
Fluoridation T,NM		80	4,15	V	G
Fluorides G,%%,AO	4.3	0.86		V	S
		0.34	4		S
Fluorides G,P,%%,AO	8.6	1.72		V	S
		0.68	4		S
Fluorides G,P,%% NM	17.2	3.44		V	S
		1.38	4		S
Fluorides in forage	–	80	11,12	A	G

Fluorides in forage		60	11,13	A	G
Fluorides in forage !		35	11,14	A	G
Fluorinert 3M-FC-70	100	100		T	PG
Formaldehyde	65	65	1	O	S
Formic Acid	1500	500		H	S
Furfural	1000	1000	1	O	S
Furfuryl Alcohol	3000	1000		H	S
Glutaraldehyde	42	14		H	PG
		35	1		
Haloperidol	3	1		H	PG
Hexachlorocyclopentadiene	6	2		H	PG
Hexamethyl Disilazane	5	2		H	PG
Hexamethylene Diisocyanate Monomer	1.5	0.5		H	PG
Hexamethylene Diisocyanate Trimer	3	1		H	PG
Hexane	35000	12000		H	G
Hydrogen Chloride	100	40		C	S
Hydrogen Cyanide	1150	575		H	S
Hydrogen Peroxide	90	30		H	PG
Hydrogen Sulphide	30	30	1	O	S
Isobutanol	1940	2640	18	O	PG
		655		O	PG
		15000	1	H	PG
		125	6	O	PG
Isobutyl Acetate	1220	1660	18	O	PG
		412		O	PG
		12700		H	PG
		79	6	O	PG
Isopropyl Acetate	1470	2000	18	O	PG

			500		O	PG
			19000		H	PG
			95	6	O	PG
Iron (Metallic)	10		4		S	S
Isopropyl Alcohol	24000		24000		O	G
Isopropyl Benzene	100		100	1	O	PG
Lead	10		3	4,5	H	S
			2	4,7	H	TS
			5	8	H	TS
Lead in Dustfall	0.1	3,4	-		H	G
Lindane (Hexachloro-cyclohexane)	15		5		H	PG
Lithium Hydrides	7.5		2.5		H	S
Lithium (other than hydrides)	60		20		H	S
Manganese Compounds !!	30		10		H	PG
Magnesium Oxide	100		100		T	S
Malathion	100		300		T	G
Maleic Anhydride	100		30		H	G
Manganese	100		50		T	S
Mercaptans (as methyl mercaptan)	20		20	1	O	S
Mercapto benzo thiazo disulphide	100		100		T	G
Mercury (alkyl)	1.5		0.5		H	S
Mercury	5		2		H	S
Metaldehyde	100		120		T	PG
Methacrylic Acid	2000		2000		O	G
Methane diphenyl di-isocyanate	3		1		H	TS

Methoxychlor	100	100		T	G
5-Methyl-2-hexanone	460	630	18	O	PG
		160		O	PG
		4600		H	PG
		30	6	O	PG
Methyl Acrylate	4	4	1	O	S
Methyl Alcohol	84000	28000		H	S
Methyl Bromide *	12000	4000		H	S
Methyl Bromide	4000	1350		H	G
Methyl Chloride	20000	7000		H	G
Methyl Chloroform	350000	115000		H	S
(1-1-1 Trichloroethane)					
Methyl Ethyl Ketone	31000	31000	1	O	S
(2-Butanone)					
Methyl Ethyl Ketone	250	80		H	G
Peroxide		200	1		G
Methyl Isobutyl					
Ketone	1200	1200		O	G
Methyl Methacrylate	860	860		O	S
Methyl-N-Amyl Ketone **					G
Methyl Salicylate	300	100		H	G
4,4 Methylene-Bis-2-	30	10		H	G
Chloroaniline					
Methylene Chloride	100000	100000	1	O	S
Methylene Dianiline	30	10		H	G
Miconazole Nitrate	15	5		H	PG
Milk Powder	20	20		S,O	S
Monomethyl Amine	25	25		O	S
Nickel	5	2		V	S
Nickel Carbonyl	1.5	.5		H	S

N trilotriacetic Acid	100	100		T	S
Nitroglycerin	10	3		H	G
N trogen Oxides	500	200		H	S
(as NO2)					
Nitrous Oxide	27000	9000		H	PG
O tane	45400	61800		O	PG
		15300		O	PG
		145000		H	PG
		2900	6	O	PG
Octene-1	150000	50000		H	PG
O alic Acid	75	25		H	PG
Ozone	200	165	1	H,V	S
P. lladium (H2O sol.) ##	30	10		H	PG
Penicillin	0.3	0.1		H	G
Pentaborane	3	1		H	S
P ntachlorophenol *	90	30		H,V	S
Pentachlorophenol	60	20		H	G
P rchloroethylene	10000	4000		H	G
Phenol	100	100		O	S
Phosgene	130	45		H	S
P osphine	30	10		H	PG
Phosphoric Acid	100	100		H,T	S
(as P2O5)					
Phosphorus Pentachloride	30	10		H	G
Phosphorus Oxychloride	40	12		H	PG
P thalic Anhydride	100	100		T	S
Pimozide	0.3	0.1		H	PG
P atinum in water	0.6	0.2		H	G
soluble compounds %					

Polychlorinated	450	16	150	16	H	G
Biphenyls (risk: .84/m)			35	16,6,10		G
Polychloroprene	100		500		T	G
Potassium Cyanide @@	100		100		T	PG
Propionic Acid	100		100	1	O	G
Propionic Anhydride	100		100	1	O	G
(exressed as propionic						
acid)						
n-Propyl Alcohol	48000		16000		H	G
Propylene Dichloride	2400		2400		O	S
Propylene Glycol Mono-	5000		5000		O	PG
methyl Ether Acetate						
Propylene Glycol Methyl	89000		121000	18	O	PG
Ether			30000		O	PG
			5700	6	O	PG
Propylene Oxide*	78000		26000		H	S
Propylene Oxide	100		4500		H	PG
Pyridine			150		H	PG
	60		80	18	O	PG
Selenium	20		10		H	G
Silane	450		150		H	PG
Silica-respirable (d<10 um)	15		5		H	G
Silver	3		1		H	S
Sodium Chlorite	60		20		H	PG
Sodium Cyanide @@	100		100		T	PG
Sodium Hydroxide	20		10		C	PG
Solvesso 100			1250		H	PG
	1250		1700	18	O	PG
			422		O	PG

			80	6	O	PG
S lvesso 150			2750		H	PG
	1250		1700	18	O	PG
			422		O	PG
			80	6	O	PG
Stannous Chloride (as Tin)	30		10		H	PG
S yrene	400		400		O	S
Sulphation	0.04	19			X	G
S lphur Dioxide	830		275		H	S
			690	1	V	S
			55	6	T	S
S lphuric Acid	100		35		C	S ← standard
Suspended Particulate TSP	100	→ in reg 308 a legal standard	120		H ↑ health	S
atter (d<44 um)		AAQC ↗ not a legal standard	60	6,7		S
T lc (fibrous)	5		2		H	G
Tellurium (except	30		10		H	S
ydrogen telluride)						
Tetrabutylurea	30		10		H	PG
T trahydrofuran	93000		93000		O	S
Tetramethyl thiuram	30		10		H	G
disulphide						
T iourea	60		20		H	PG
Tin	30		10		H	S
T tanium	100		100		T	S
Tolmetin Sodium	15		5		H	PG
Toluene	2000		2000		O	S
T luene Di-isocyanate	1		0.5		H	S
Total Reduced Sulphur	40		40	1	O	PG
TRS) as equivalent H2S						
(from Kraft Pulp Mills)						

1,2,4-Trichlorobenzene	100	400	T	G
Trichloroethylene	85000	28000	H	S
Trifluorotrichloro Ethane	2.4M	800000	H	S
Trimethyl Amine	0.5	0.5 1	O	G
1,2,4-Trimethylbenzene	100	1000	T	G
Tripropyltin Methacrylate	3	1		G
Vanadium	5	2	H	S
Vinyl Chloride	560	280	H	G
Vinylidene Chloride * (1,1-Dichloro Ethene)	26000	8600	H	S
Vinylidene Chloride	70	35	H	PG
Whey Powder	100		T	PG
Xylenes	2300	2300	O	S
Zinc	100	100	T	S

DEFINITIONS FOR ABBREVIATIONS IN LIST OF STANDARDS, TENTATIVE STANDARDS, GUIDELINES, AND PROVISIONAL GUIDELINES

A	-	Effects on Animals
C	-	Corrosion
G	-	Gaseous
H	-	Health
I	-	Irritant property
M	-	Million
O	-	Odour
P	-	Particulate
S	-	Soiling
as	-	All Sources
ss	-	Single Source
t	-	Total
T	-	TSP (total suspended particulate) standard
V	-	Vegetation
W	-	Corrosivity of reaction product with water
X	-	SO2 activity
Z	-	High background levels from automobiles
AO	-	April 1 - October 31
GS	-	Growing season
		May 1 - September 30 - NE & NW regions
		April 1 - October 31 - other regions
NM	-	November 1 - March 31
!	-	Criterion
!!	-	Including Potassium Permanganate as Manganese
@	-	ug/m2
@@	-	As total salt
#	-	Total Asbestos
##	-	Water soluble forms including Palladium Chloride as Palladium
%	-	Including Hexachloroplatinic Acid as Platinium
%%	-	As HF
*	-	changed
**	-	under review, for details see contact
1	-	1 hour
2	-	8 hour
3	-	g/m2
4	-	30 day
5	-	arithmetic mean
6	-	1 year
7	-	geometric mean
8	-	single sample
9	-	fibres of length > 5um
10	-	average
11	-	ppm
12	-	dry weight, any single month
13	-	dry weight, average of 2 consecutive monthes
14	-	dry weight, average of monthly results for growing season
15	-	ug/cm2
16	-	ng/m
17	-	pg/m
18	-	10 minute
19	-	mg SO3/100 cm2/day
POI	-	Point of Impingement - ug/m

AACQ - Ambient Air Quality Criterion - ug/m
LE - Limiting Effect
ST - Type of Standard :
S - Standard
TS - Tentaive Design Standard
G - Guideline
PG - Provisional Guideline

a - average
a.m. - arithmetic mean
cm - cubic centimetre
cm2 - square centimetre
d - days
g - gram
g.m. - geometric mean
h - hour
m - cubic metre
mg - milligram - 10-3 g
m2 - square metre
n - nanogram - 10-9 g
pg - picogram - 10-12 g
ppm - parts per million
ug - microgram - 10-6 g
um - micrometre
y - year

fluoridation is measured by exposing a 100 cm2 limed filter paper for 30d.

contact: Emission Technology and Regulation Development Section
Air Resources Branch
Ontario Ministry of the Environment
416-965-5776

HALTON REGION LANDFILL TECHNICAL STUDY
AIR QUALITY ANALYSIS
SITE D
SCHEDULE I-D
ERRATA AND CORRECTIONS

Replace List of Tables with Revised List of Tables

Page 2-1, first paragraph, last sentence, replace with:

Meteorological data were obtained from nearby stations operated by the Atmospheric Environment Service of Environment Canada.

Page 4-3, 3rd paragraph, replace with:

The results obtained during the one year sampling program are summarized in Tables 4.4 and 4.5. Although the levels are lower than those at any of the MOE sites these results should not be construed as representing the average annual air quality of the sites. Seasonal and annual variations in wind speed, wind direction and precipitation all may affect the levels of TSP encountered. The levels of TSP in the atmosphere range from a low of 8 to a high of 103 $\mu g/m^3$. The geometric mean of the data collected to date is 32 $\mu g/m^3$. These data are typical of suburban and rural areas. These data indicate satisfactory ambient air quality with respect to TSP.

Page 4-3, last paragraph, replace with:

Table 4.6 summarizes the dustfall data obtained from the MOE monitoring network at the nearest locations to Site D. The values at these stations range from 0.4 $g/m^2/30$ days (Station No. 44015) to 30.0 $g/m^2/30$ days (Station

No. 44006) but at only two (Station No. 44071, 44070) does the annual mean exceed the criterion of 4.6 $g/m^2/30$ days in recent years. It must be noted that in most cases dustfall samplers are located in urban areas or near to potential problem areas for the purpose of determining whether or not high dustfalls occur. Of the monitors listed, numbers 44015 and 44061 most closely approximate rural or suburban locations insofar as they are not situated in the more densely populated areas of Oakville.

Page 4-4, second and third paragraphs, replace with:

In addition to monitoring total suspended particulate matter at the Boyne Community Centre air quality monitoring station, dustfall measurements were also taken. The dustfall data are summarized in Table 4.7. The dustfall measured during the year ranged from 0.1 to 4.8 $g/m^2/30$ days. The mean of the data collected to date is 1.8 $g/m^2/30$ days. These levels are within the ambient air quality criteria and are typical for the area.

Following page 4-3, replace Table 4.4 with revised Table 4.4

Following page 4-3, replace Table 4.5 with revised Table 4.5

Following page 4-4, replace Table 4.7 with revised Table 4.7

Page 4-5, Section 4.2.5, replace with:

4.2.5 Summary of Air Quality Data

In general the dustfall, total suspended particulate matter and odour related air quality parameters that have been monitored in the area of Site D are within existing MOE air quality criteria. The estimated air quality, based on measurements made during this study and on available MOE data can be summarized as follows.

Contaminant	Sampling period	Estimated Range	MOE Criteria
Total Suspended Particulate Matter:	Annual Geometric Mean	25 to 40 $\mu g/m^3$	60 $\mu g/m^3$
	24 hour maximum	100 to 150 $\mu g/m^3$	120 $\mu g/m^3$
	24 hour minimum	5 to 15 $\mu g/m^3$	
Dustfall:	Annual Arithmetic Mean	1 to 3 $g/m^2/30$ days	4.6 $g/m^2/30$ days
	Maximum monthly	4 to 5 $g/m^2/30$ days	7 $g/m^2/30$ days
	Minimum monthly	0 to 1 $g/m^2/30$ days	
Odour:		infrequent agricultural odours	detectable

Page 4-6, second paragraph, replace with:

In dry weather winds can create suspended particulate matter by erosion of soils and by entrainment of dusts from surfaces upon which they have been deposited. High wind speeds result in the dilution of contaminants which are released at a constant rate, but also increase the erosion and entrainment of particulate material. As a general rule winds of less than 5 m/s do not result in erosion and above that speed the dilution effect of the wind results in lower concentrations of contaminants as the wind speed increases. At very high wind speeds erosion can become a dominant factor if large areas of exposed soil are affected.

Following page 4-8, replace Table 4.10 with revised Table 4.10

Page 4-10, first paragraph, replace with:

The predominant wind directions at Lester B. Pearson International Airport are from the north and west both occurring 11% of the time annually. The next highest frequency is from the north northwest occurring 9% of the time. The average wind speeds from the north and west directions are 14.8 km/hr and 18.1 km/hr respectively. The highest wind speeds occur with winds from the west northwest which have a frequency of 7.1% annually. The most infrequent wind directions are from the east northeast and northeast occurring 2.3% and 2.6% annually. Calm conditions are experienced 5% annually. The highest wind speeds occur in January (18.4 km/hr), and the lowest in August (12.3 km/hr). The maximum hourly wind speed was 97 km/hr from the southwest. The maximum gust speed was 124 km/hr also from the southwest.

Following page 4-14, replace Table 4.13 with revised Table 4.13

Following page 4-14, replace Key to Tables 4.13 and 4.14 with Revised Key to Table 4.13

Following page 4-15, replace Table 4.14 with revised Table 4.14

Following page 4-15, replace key to Table 4.13 and 4.14 with Revised Key to Table 4.14

REVISED LIST OF TABLES

List of Tables cont'd

Revised Table 4.4

TOTAL SUSPENDED PARTICULATE MATTER CONCENTRATIONS - SITE D (ug/m^3)

Date	TSP at Boyne ($\mu g/m^3$)	Date	TSP at Boyne ($\mu g/m^3$)
07/09/85	27.6	02/04/86	11.9
10/09/85	17.5	05/04/86	21.1
13/09/85	14.3	08/04/86	12.8
16/09/85	52.7	11/04/86	11.2
19/09/85	71.4	14/04/86	--
22/09/85	51.7	17/04/86	73.5
25/09/85	32.4	20/04/86	38.8
28/09/85	27.6	23/04/86	23.2
		26/04/86	83.0
01/10/85	23.4	29/04/86	30.5
04/10/85	39.7		
07/10/85	23.1	03/05/86	24.8
10/10/85	35.7	05/05/86	92.7
13/10/85	18.8	09/05/86	47.6
16/10/85	13.4	11/05/86	55.1
19/10/85	20.4	14/05/86	93.1
22/10/85	44.5	17/05/86	41.5
25/10/85	15.6	20/05/86	--
28/10/85	11.0	23/05/86	13.3
31/10/85	48.3	26/05/86	49.3
		29/05/86	70.3
03/11/85	--		
06/11/85	8.0	01/06/86	50.1
09/11/85	8.6	04/06/86	87.5
12/11/85	88.9	07/06/86	60.8
15/11/85	30.1	10/06/86	75.3
18/11/85	35.3	13/06/86	22.3
21/11/85	18.8	16/06/86	46.7
24/11/85	23.5	19/06/86	41.7
27/11/85	18.4	22/06/86	58.9
30/11/85	22.3	26/06/86	19.5
		28/06/86	--
03/12/85	30.9		
09/12/85	30.6	01/07/86	36.7
15/12/85	27.6	04/07/86	41.9
21/12/85	23.4	07/07/86	--
27/12/85	18.0	10/07/86	--
		13/07/86	25.0
02/01/86	50.0	16/07/86	62.5
08/01/86	31.0	19/07/86	42.5
14/01/86	17.9	22/07/86	62.9
20/01/86	16.1	25/07/86	87.7
26/01/86	30.8	28/07/86	64.7
		31/07/86	49.6
01/02/86	30.5		
07/02/86	14.4	03/08/86	15.0
13/02/86	31.0	06/08/86	45.5
20/02/86	33.4	09/08/86	17.5
25/02/86	24.1	12/08/86	33.7
		15/08/86	57.6
03/03/86	102.5	18/08/86	38.7
09/03/86	39.5	21/08/86	43.0
15/03/86	35.4	24/08/86	14.7
21/06/86	28.5	27/08/86	14.4
27/03/86	21.0	30/08/86	32.2
		Geometric Mean	31.6

Note

On those days for which no data are recorded, equipment failure prevented collection of a valid sample.

Revised Table 4.5

DISTRIBUTION OF TOTAL SUSPENDED PARTICULATE MATTER DATA - SITE D

Range ($\mu g/m^3$)	No. of Samples	Cumulative
100-110	1	1
90-100	2	3
80-90	4	7
70-80	4	11
60-70	4	15
50-60	6	21
40-50	13	34
30-40	20	54
20-30	17	71
10-20	21	92
0-10	2	94

Revised Table 4.7

DUSTFALL DATA - SITE D

Dustfall (g/m^2/30 days)

		Boyne
September 1985	A	4.8
	B	3.3
October 1985	A	1.7
	B	1.7
November 1985	A	2.3
	B	1.6
December 1985	A	0.9
	B	1.0
January 1986	A	0.7
	B	1.1
February 1986	A	0.2
	B	0.2
March 1986	A	1.2
	B	1.0
April 1986	A	0.1
	B	1.5
May 1986	A	2.1
	B	1.5
June 1986	A	1.7
	B	2.9
July 1986	A	2.7
	B	4.2
August 1986	A	2.1
	B	1.9
Mean		1.8

Revised Table 4.10

MONTHLY VARIATION IN PRECIPITATION SITE D AREA*

Total precipitation (mm) monthly means 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
61.4	55.4	66.2	75.4	67.7	67.7	66.8	82.3	68.7	68.2	67.6	69.6	817.0

Average Annual Number of days with measurable precipitation 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
11	10	11	11	10	9	8	9	8	9	10	13	117

Monthly Mean Rainfall (mm) 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
24.1	26.6	43.4	69.9	67.8	67.7	66.8	82.3	68.7	67.5	60.2	41.2	686.2

Average Annual Number of days with measurable rainfall 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
3	3	6	10	10	9	8	9	8	9	8	5	89

Monthly Mean Snowfall (cm) 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
35.2	28.1	19.2	5.5	0.0	0.0	0.0	0.0	0.0	1.1	7.5	27.2	123.8

Average Annual Number of days with measurable snowfall 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
3	3	6	10	10	9	8	9	8	9	8	5	89

* All values are averages of values from the Oakville, Burlington, and Milton-Kelso meteorological Stations.

Reference: Environment Canada, 1982a

REVISED KEY TO REVISED TABLE 4.13
SITE D

Symbol	Definition		Assumed Value
S =	Silt content of soil		15%
m =	Moisture content of soil	- subsoil	12%
W =	Weight of vehicle	- scraper loaded	42 T
		- scraper empty	30 T

EMISSION ESTIMATES CONSTRUCTION PERIOD
SITE D

(1)	(2) Basis of Estimate	(3) Estimated Value	(4) Uncontrolled Emission Rate	(5) Possible Emission Reduction %	(6) Controlled Emission Rate kg/h
Scraper: Removal (6)	0.029 kg/T	0.029 kg/T	31.3 kg/h	0	31.3
Scraper: Haul to Berm (6)	$9.6 \times 10^{-6} (S)^{1.3}(W)^{2.4}$ kg/VKT	2.6 kg/VKT	85.3 kg/h	0	85.3
Return	$9.6 \times 10^{-6} (S)^{1.3}(W)^{2.4}$ kg/VKT	1.1 kg/VKT	36.1 kg/h	0	36.1
Scraper: Discharge (6)	0.02 kg/T	0.02 kg/T	21.6 kg/h	0	21.6
Bulldozers* (2)	$\frac{2.6\ (S)^{1.2}}{(m)^{1.3}}$ kg/h	2.65 kg/h	5.3 kg/h	0	5.3
Wind Erosion***	0.85 T/hectare/yr	0.085 $kg/m^2/yr$	0.8 kg/h	100%**	0.0
Front End Loader	18 g/m^3	1.52 kg/week max.	<0.1 kg/h	25%	<0.1

Notes
* M=12% (in clay) mostly subsoil.
** Ground cover after construction completed.
*** Berm only cells in operation are below ground level.

References: CDOH, 1981; U.S. EPA, 1981' U.S. EPA, 1985.

REVISED KEY TO REVISED TABLE 4.14

Symbol	Definition		Assumed Value
S =	Silt content of soil		15%
m =	Moisture content of soil - subsoil		12%
K =	Factor for particle size distribution		0.8
V =	Speed of vehicle		30 km/h
w =	No. of wheels	- haul truck	8
		- others	4
W =	Weight of vehicle	- scraper-average	30 T
H =	Height of soil drop		1 m
Y =	Dumping device capacity		7 m^3
u =	Mean wind speed		5 m/s
p =	Number of days with measurable precipitation		117

Revised Table 4.14

EMISSION ESTIMATES - OPERATIONS SITE D

(1)	(2) Basis of Estimate	(3) Estimated Value	(4) Uncontrolled Emission Rate	(5) Possible Emission Reduction %	(6) Controlled Emission Rate kg/h
Scraper: Removal (small)	0.029 kg/T	0.029 kg/T	1.0 kg/h	1.0	1.0
Scraper: Haul	$9.6 \times 10^{-6}\,(S)^{1.3}(W)^{2.4}$ kg/VKT	1.1 kg/VKT	1.3 kg/h	0	1.3
Scraper: Discharge	0.02 kg/T	0.02 kg/T	0.7 kg/h	0	0.7
Bulldozers (2)	$\frac{2.6\,(S)^{1.2}}{(m)^{1.3}}$ kg/h	2.65 kg/h	1.3 kg/h	0	1.3
Front End Loader	18 g/m^3	18 g/m^3	0.62 kg/h	25%	0.5
Compactors (2)	4.6 g/s	4.6 g/s	8.3 kg/h	0	8.3
Truck Traffic	$1.7\,K \left(\frac{S}{12}\right)\left(\frac{V}{48}\right)\left(\frac{W}{2.7}\right)^{0.7}\left(\frac{w}{4}\right)^{0.5}\left(\frac{365-p}{365}\right)$ kg/VKT	0.24 to 1.8 kg/VKT	46.2 kg/h	75%	11.6
Soil Haul to Pile	$1.7\,K \left(\frac{S}{12}\right)\left(\frac{V}{48}\right)\left(\frac{W}{2.7}\right)^{0.7}\left(\frac{w}{4}\right)^{0.5}\left(\frac{365-p}{365}\right)$ kg/VKT	3.4 kg/VKT	10.5 kg/h	75%	2.6
Soil Drop	$\frac{0.73 \times 0.0009 \left(\frac{S}{5}\right)\left(\frac{U}{2.2}\right)\left(\frac{H}{1.5}\right)}{\left(\frac{M}{2}\right)^{2}\left(\frac{Y}{4.6}\right)^{0.33}}$ kg/T	7.2×10^{-5} kg/T	<0.1 kg/h	0	<0.1 kg/h
Wind Erosion*	0.85 T/hectare/yr	0.085 $kg/m^3/yr$	1.9 kg/h	0	1.9 kg/h

References: CDOH, 1981; U.S. EPA, 1981; U.S. EPA,1985.

Notes:

* Only occurs when windspeed exceeds 20 km/h.

HALTON REGION LANDFILL TECHNICAL STUDY
AIR QUALITY ANALYSIS
SITE F
SCHEDULE I-F
ERRATA AND CORRECTIONS

Replace List of Tables with Revised List of Tables

Replace List of Figures with Revised List of Figures

Page 2-1, first paragraph, last sentence, replace with:

Meteorological data were obtained from nearby stations operated by the Atmospheric Environment Service of Environment Canada.

Page 2-1, second paragraph, second sentence, replace with:

The proposed operating procedures were based on current practices at Halton's landfill and on information from Hydrology Consultants, regarding site design and operational procedures, and from Giffels Associates Limited, regarding transportion.

Page 4-3, third paragraph, replace with:

The results obtained during the one year sampling program are summarized in Tables 4.4 and 4.5. Although the levels are lower than those at any of the MOE sites these results should not be construed as representing the average annual air quality of the sites. Seasonal and annual variations in wind speed, wind direction and precipitation all may affect the levels of TSP encountered.

The levels of TSP in the atmosphere ranged from a low of 9 to a high of 104 $\mu g/m^3$. The geometric mean of the data collected over the year is 33 $\mu g/m^3$. These data are typical of suburban and rural areas. These data indicate satisfactory ambient air quality with respect to TSP.

Page 4-3, last paragraph, replace with:

Table 4.6 summarizes the dustfall data obtained from the MOE monitoring network at the nearest locations to Site F. The values at these stations ranged from 0.4 $g/m^2/30$ days (Station No. 44015) to 30.0 ($g/m^2/30$ days) (Station No. 44006) but at only two (Station No. 44071, 44070) has the annual mean exceeded the criterion of 4.6 $g/m^2/30$ days in recent years. It must be noted that in most cases dustfall samplers are located in urban areas or next to potential problem areas for the purpose of determining whether or not high dustfalls occur. Of the monitors listed, numbers 44015 and 44061 most closely approximate rural or suburban locations insofar as they are not situated in the more densely populated areas of Oakville.

Page 4-4, second and third paragraphs, replace with:

In addition to monitoring total suspended particulate matter information at the Waterdown air quality monitoring station, dustfall measurements were also taken. The dustfall data for the Waterdown station are summarized on Table 4.7. The dustfall measured during the year has ranged from 0.5 to 12.5 $g/m^2/30$ days. The mean of the data collected to date is 2.8 $g/m^2/30$ days. Except for the one anomolous measurement of 12.5 these levels are within the ambient air quality criteria and are typical for the area.

Following page 4-3, replace Table 4.4 with the revised Table 4.4

Following page 4-3, replace Table 4.5 with the revised Table 4.5

Following paper 4-4, replace Table 4.7 with the revised Table 4.7

Page 4-5, first paragraph, replace with:

In general the dustfall, total suspended particulate matter and odour related air quality parameters that have been measured in the area of Site F are within existing MOE air quality criteria. The estimated air quality based on measurements made during this study and on available MOE data can be summarized as follows.

Contaminant	Sampling period	Estimated Range	MOE Criteria
Total Suspended Particulate Matter:	Annual Geometric Mean	25 to 40 $\mu g/m^3$	60 $\mu g/m^3$
	24 hour maximum	100 to 150 $\mu g/m^3$	120 $\mu g/m^3$
	24 hour minimum	5 to 15 $\mu g/m^3$	
Dustfall:	Annual Arithmetic Mean	1 to 3 g/m^2/30 days	4.6 g/m^2/30 days
	Maximum Monthly	4 to 5 g/m^2/30 days	7 g/m^2/30 days
	Minimum Monthly	0 to 1 g/m^2/30 days	
Odour:		No detectable odours.	Detectable.

Page 4-6, first paragraph, replace with:

In dry weather winds can create suspended particulate matter by erosion of soils and by entrainment of dusts from surfaces upon which they have been deposited. High wind speeds result in the dilution of contaminants which are released at a constant rate, but also increase the erosion and entrainment of particulate material. As a general rule winds of less than 5 m/s do not result in erosion and above that speed the dilution effect of the wind results in lower concentrations of contaminants as the wind speed increases. At very high wind speeds erosion can become a dominant factor if large areas of exposed soil are affected.

Following page 4-8, replace Table 4.10 with the revised Table 4.10

Following page 4-8, replace Figure 4.2 with Revised Figure 4.2

Following page 4-10, replace Table 4.12 with the revised Table 4.12

Page 4-9, last paragraph, replace the first sentence with:

The predominant wind direction at the Hamilton RBG station is from the southwest.

Page 4-11, last paragraph, replace with:

Using information from the Design and Operations Report for Site F (Hydrology Consultants, 1986) and the Addendum to Halton Region Landfill Technical Report, Site F - Burlington, Design and Operations Report (Trow Hydrology Consultants Limited, May 1987), the following site preparation work will be carried out:

- installation of perimeter fencing and gates
- construction of storm drainage ditches, diversion channels and retention ponds
- excavation of part of the first cell
- installation of part of the leachate collection system

- construction of perimeter roads
- construction of the screening berm adjacent to Bayview Park
- construction of dykes
- infilling of stream valleys
- stockpiling of cover material

Using this information and current general practices probable construction activities were assumed. These assumptions with regard to the site and its operation are detailed below.

The general layout of Site F and its surrounding areas is shown in Figure 4.4. A berm along the eastern side of the property opposite the equestrian facilities will be built in first month of construction. Infilling of stream valleys and building of dykes will also begin in the first month and continue for about three to four months. Thereafter construction activities will consist of excavation and stockpiling of cover material on berms along the north and south ends of the eastern border, across the northern boundary of the site and along a portion of the southern boundary.

Q. Most of the cover material to be excavated will be stockpiled within the first two years. The berm opposite the equestrian facility will serve as a sound barrier, reducing the noise impact on people in Bayview Park. NOT TRUE how know?

During the construction period of 3 to 4 months, three scrapers working an average of 10 hours per day for 5 days per week will make about 12 trips per hour during dyke construction and stream valley infill. Scrapers building the berm will make about six trips per hour. In addition it is assumed three bulldozers and one front end loader will be used in assisting with soil and overburden handling. 7

In the subsequent stockpiling activities it is assumed that two scrapers are used and that they average about six trips per hour. The scrapers are assumed to be assisted by three bulldozers and one front end loader. 6

SENES

Estimates of dust emissions from the use of these machines have been made using emission factors and equations. The hourly emissions rates from equipment in operation during site construction are shown on Revised Table 4.13(a). It is assumed that the full site will be developed starting at about the middle of the site and progressing to the northeast in the first phase, then beginning at the southern boundary and progressing to the northeast in the final phase of landfilling. Traffic is expected to enter the site from an existing road at the southwestern corner of the site and as far as possible to follow the site boundaries before proceeding to the tipping area.

Following page 4-11, insert Table 4.13(a)-1 and Table 4.13(a)-2

Following Page 4-11, insert Key to Table 4.13(a)-1 and Table 4.13(a)-2

Following page 4-11, replace Table 4.13 with revised Table 4.13

Following page 4-11, replace Key to Table 4.13 with revised Key to Table 4.13

Page 4-13, remove the first paragraph beginning with

"Because the berm is constructed ...."

Page 4-14, second last paragraph, replace with

For the long term annual average estimates, STAR datafiles were created using the meteorological conditions measured at the Hamilton Royal Botanical Gardens meteorological station.

Page 4-14, following the last paragraph, insert

During the first four weeks of construction elevated average concentrations may occur when winds are from the southeast. Winds blow on average from the southeast for two percent of the time.

The nearest residents to the north could experience daily average concentrations of about 120 μg/m^3 when winds are continuously from the southeast. The probability of this very small, perhaps one day. For the rest of the time in the first four weeks daily average concentrations will average below 100 ug/m^3. In weeks 5 to 13 of the construction period daily average concentrations at the nearest residences to the north will average below 100 μg/m^3.

At the southern corner of Bayview Park, next to the landfill boundary daily average concentrations may reach 120 μg/m^3 in weeks 5 to 13 when excavating, infilling, and dyke construction are taking place simulataneously. At the equestrian facilities the daily average concentrations would be below 100 μg/m^3 during the working week. On the weekends when construction has ceased there would be no construction dust carried to the park.

In the first two years when landfill operations and stockpiling activities are being carried on simultaneously the calculated point of impingement concentration may exceed 100 μg/m^3 very briefly at the nearest residences when there is a southeast wind and when most of the emissions sources are upwind of the homes. The probability of this occurring is very small since southeast winds occur on average about 2 percent of the time. For about 98 percent of the time, emissions will not be carried to the nearest homes and the point of impingement concentration will be low or zero. Mitigation is possible when southeast winds occur. Emissions can be reduced by using normal dust abatement techniques of watering roads and haul routes, and spraying working surfaces. Stockpiling activities could be reduced thereby reducing emissions or stockpiling could be shifted to one of the other areas to the south of landfill operations when winds are from the southeast. These mitigation measures would reduce the point of impingement concentrations at the nearest homes to acceptable levels. When stockpiling activities are completed, the landfill related emissions shown in Table 4.13 will be generated over the remaining 18 years.

Page 4-15, first paragraph, replace with

Calculated half hour point of impingement concentrations ranging from 140 to 200 $\mu g/m^3$ may occur in Bayview Park at some stage in the site's history. These concentrations will arise when winds are 5 m/s or less, under D stability conditions, the wind is blowing from the site operations towards the park and the distance between the park and operations on the site is at a minimum. These conditions are quite rare and the meteorological conditions occur for less than four percent of the time. The landfill site is in operation for less than one third of the time and the full impact is felt only for a part of the site's life and not on weekends. Concentrations at the nearest residences are predicted to be below 40 $\mu g/m^3$.

Page 4-15, second paragraph, replace with

Average annual concentrations estimated by the ISCLT model indicate that concentrations will be well below the MOE Ambient Air Quality Criteria and will not exceed 12 $\mu g/m^3$ at the nearest residence.

Page 5-1, first paragraph, replace with

Site F can be developed into an acceptable landfilling operation from an air quality point if view. There may be some dust impacts on the nearest residences to the north and Bayview Park during construction but the probable frequency is low. Limiting activities in the area of the landfill closest to Bayview Park during days when the park is in use will reduce any predicted impacts to acceptable levels. Except for infrequent elevated levels of dust

dust impacts at Bayview

in Bayview Park, no other off-site impacts are predicted. All of the predicted impacts are summarized on Tables 5.1 and 5.2.

Page 5-1, second paragraph, replace with

On Table 5.2 the terms "nil", "low", "medium" and "high" are defined below;

nil:	no emission and no possible impact
low:	suspended particulate emissions are present but no exceedances of provincial air quality criteria (Section 4.2.1) are predicted
medium:	suspended particulate emissions are present but no exceedances of provincial air quality criteria (Section 4.2.1) are predicted at residences
	some exceedances (less than 10 percent of the time) are possible at the site boundaries depending on the meteorology
high:	predicted suspended particulate concentrations are likly to exceed provincial air quality criteria (ection 4.2.1) more than half the time

Following Page 5-1, replace Table 5.1 with Revised Table 5.1

Following Page 5-1, replace Table 5.2 with Revised Table 5.2

REVISED LIST OF TABLES

REVISED LIST OF FIGURES

Revised Table 4.4

TOTAL SUSPENDED PARTICULATE MATTER CONCENTRATIONS - SITE F (ug/m^3)

Date	TSP at Waterdown Road ($\mu g/m^3$)	Date	TSP at Waterdown Road ($\mu g/m^3$)
07/09/85	49.6	02/04/86	23.1
10/09/85	23.5	05/04/86	25.3
13/09/85	--	08/04/86	11.1
16/09/85	43.0	11/04/86	12.6
19/09/85	72.8	14/04/86	--
22/09/85	31.1	17/04/86	35.7
25/09/85	36.7	20/04/86	32.7
28/09/85	29.1	23/04/86	30.9
		26/04/86	66.1
01/10/85	23.9	29/04/86	35.1
04/10/85	54.6		
07/10/85	24.6	03/05/86	25.2
10/10/85	34.2	05/05/86	103.9
13/10/85	20.3	09/05/86	41.9
16/10/85	12.1	11/05/86	33.2
19/10/85	18.9	14/05/86	78.9
22/10/85	36.7	17/05/86	43.3
25/10/85	18.0	20/05/86	16.5
28/10/85	19.8	23/05/86	20.8
31/10/85	31.4	26/05/86	50.2
		29/05/86	70.0
03/11/85	12.6		
06/11/85	9.2	01/06/86	55.8
09/11/85	12.3	04/06/86	86.4
12/11/85	50.8	07/06/86	63.6
15/11/85	21.5	10/06/86	79.8
18/11/85	50.3	13/06/86	28.6
21/11/85	23.3	16/06/86	67.5
24/11/85	25.9	19/06/86	43.2
27/11/85	25.8	22/06/86	62.4
30/11/85	24.3	26/06/86	17.2
		28/06/86	27.6
03/12/85	38.2		
09/12/85	41.1	01/07/86	31.1
15/12/85	29.1	04/07/86	44.7
21/12/85	27.3	07/07/86	63.8
27/12/85	24.4	10/07/86	50.5
		13/07/86	25.9
02/01/86	49.9	16/07/86	71.7
08/01/86	37.1	19/07/86	41.5
14/01/86	30.1	22/07/86	62.4
20/01/86	14.3	25/07/86	89.8
26/01/86	33.1	28/07/86	43.2
		31/07/86	40.5
01/02/86	38.9		
07/02/86	11.0	03/08/86	16.6
13/02/86	40.6	06/08/86	59.9
20/02/86	29.7	09/08/86	19.5
25/02/86	22.3	12/08/86	23.0
		15/08/86	60.1
03/03/86	98.8	18/08/86	41.9
09/03/86	42.9	21/08/86	46.2
15/03/86	36.6	24/08/86	--
21/06/86	29.3	27/08/86	11.4
27/03/86	25.1	30/08/86	34.2
		Geometric Mean	33.2

Note

On those days for which no data are recorded, equipment failure prevented collection of a valid sample.

Revised Table 4.5

DISTRIBUTION OF TOTAL SUSPENDED PARTICULATE MATTER DATA - SITE F

Range ($\mu g/m^3$)	No. of Samples	Cumulative
100-110	1	1
90-100	1	2
80-90	2	4
70-80	4	8
60-70	8	16
50-60	7	23
40-50	15	38
30-40	17	55
20-30	26	81
10-20	15	96
0-10	1	97

Revised Table 4.7

DUSTFALL DATA - SITE F

Dustfall (g/m^2/30 days)

		Waterdown
September 1985	A	2.8
	B	3.3
October 1985	A	1.7
	B	2.0
November 1985	A	4.4
	B	1.1
December 1985	A	1.7
	B	1.7
January 1986	A	1.6
	B	1.1
February 1986	A	0.5
	B	1.4
March 1986	A	3.0
	B	3.1
April 1986	A	1.6
	B	1.6
May 1986	A	2.4
	B	2.4
June 1986	A	7.1
	B	12.5
July 1986	A	2.9
	B	2.5
August 1986	A	2.2
	B	2.5
Mean		2.8

exceeded MOE criteria of 7 (per month)

a bit higher than at site D.

below 4.6 set by MOE.

Revised Table 4.10

MONTHLY VARIATION IN PRECIPITATION - SITE F AREA*

Total precipitation monthly means 1951-1980 (mm)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
69.3	58.4	71.1	79.5	68.2	69.3	64.3	82.3	72.9	66.3	68.1	75.6	845.3

Average Annual Number of days with measurable precipitation 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
12	10	11	11	10	9	8	9	9	10	11	13	126

Monthly Mean Rainfall (mm) 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
26.0	26.5	49.6	74.0	68.2	69.3	64.3	82.3	72.9	65.5	60.7	44.0	703.3

Average Annual Number of days with measurable rainfall 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
4	3	7	10	10	9	8	9	9	10	9	6	96

Monthly Mean Snowfall (cm) 1951-1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
41.8	31.1	19.9	5.4	0.0	0.0	0.0	0.0	0.0	1.2	7.6	30.7	137.7

Average Annual Number of days with measurable snowfall 1951-1980

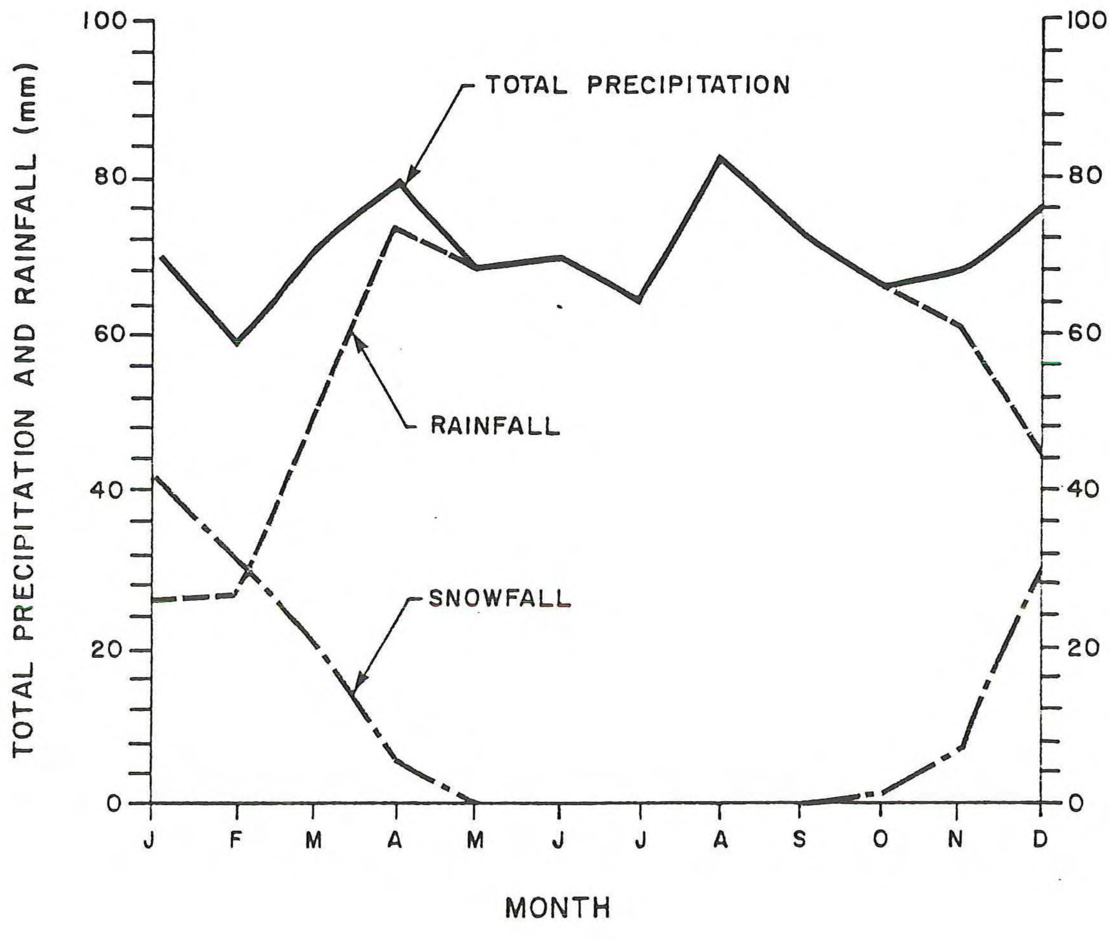
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
10	8	5	2	0	0	0	0	0	0	2	8	35

* All values are averages of values from the Hamilton RGB, Burlington TS and Milton-Kelso meteorological stations.

Reference: Environment Canada, 1982a

REVISED FIGURE 4.2

TOTAL PRECIPITATION, RAINFALL, AND SNOWFALL SITE F AREA



Revised Table 4.12

ANNUAL FREQUENCY OF OCCURRENCE OF STABILITY CLASSES

Hamilton Royal Botanical Gardens

Stability Class		Annual Frequency of Occurrence(%)
A	Extremely unstable	0.4
B	Moderately unstable	6.5
C	Slightly unstable	12.0
D	Neutral	47.5
E	Moderately Stable	9.9
F	Extremely stable	23.7

KEY TO TABLE 4.13(a)-1 and Table 4.13(a)-2

SITE F

Symbol	Definition		Assumed Value
S =	Silt content of soil		15%
m =	Moisture content of soil	- subsoil	12%
W =	Weight of vehicle	- scraper loaded	42 T
		- scraper empty	30 T

Table 4.13(a)-1

EMISSION ESTIMATES-CONSTRUCTION - PERIOD (WEEKS 1 to 13)
SITE F

	Basis of Estimate	Estimated Value	Uncontrolled Emission Rate	Possible Emission Reduction %	Controlled Emission Rate (kg/h)
Scraper: Removal (3)	0.029 kg/T	0.029 kg/T	8.4 kg/h	0	8.4
Scraper: Haul to Berm (3)	$9.6 \times 10^{-6} (S)^{1.3}(W)^{2.4}$ kg/VKT	2.6 kg/VKT	18.7 kg/h (31.2)†	0	18.7 (31.2)†
Return	$9.6 \times 10^{-6} (S)^{1.3}(W)^{2.4}$ kg/VKT	1.1 kg/VKT	7.9 kg/h (13.2)†	0	7.9 (13.2)†
Scraper: Discharge (3)	0.02 kg/T	0.02 kg/T	5.8 kg/h	0	5.8
Bulldozers * (3)	$\frac{2.6\,(S)^{1.2}}{(m)^{1.3}}$ kg/h	2.65 kg/h	8.0 kg/h	0	8.0
Wind Erosion***	0.85 T/hectare/yr	0.085 $kg/m^2/yr$	0.6 kg/h	100	0.6***
Front End Loader (1)	18 g/m^3	0.018 kg/m^2	0.6 kg/h	25%	0.5

Notes
* M=12% (in clay) mostly subsoil.
** Ground cover after construction completed.
*** Occurs at windspeeds greater than 20 km per hour.
† Emissions during weeks 1 to 4, Emissions from other activities are the same from weeks 1 to 13.

References: CDOH, 1981; U.S. EPA, 1981; U.S. EPA, 1985.

Table 4.13(a)-2

EMISSION ESTIMATES CONSTRUCTION - PERIOD (WEEKS 14 to 80)
SITE F

Where do these #s come from?

	Basis of Estimate	Estimated Value	Uncontrolled Emission Rate	Possible Emission Reduction %	Controlled Emission Rate (kg/h)
Scraper: Removal (2)	0.029 kg/T	0.029 kg/T	4.2 kg/h	0	4.2
Scraper: Haul to Berm (2)	$9.6 \times 10^{-6} (S)^{1.3} (W)^{2.4}$ kg/VKT	2.6 kg/VKT	29.6 kg/h (25.0)†	0	29.6 (25.0)†
Return	$9.6 \times 10^{-6} (S)^{1.3} (W)^{2.4}$ kg/VKT	1.1 kg/VKT	12.5 kg/h (10.6)†	0	12.5 (10.6)†
Scraper: Discharge (2)	0.02 kg/T	0.02 kg/T	2.9 kg/h	0	2.9
Bulldozers * (3)	$\frac{2.6\ (S)^{1.2}}{(m)^{1.3}}$ kg/h	2.65 kg/h	8.0 kg/h	0	8.0
Wind Erosion ***	0.85 T/hectare/yr	0.085 kg/m^2/yr	0.4 kg/h	100%	0.4
Front End Loader	18 g/m^3	0.018 kg/m^3	0.6 kg/h	25%	0.5

Notes

* M=12% (in clay) mostly subsoil.

** Ground cover after construction completed.

*** Occurs at windspeeds greater than 20 km per hour.

† Emissions during weeks 14 to 47, Emissions from other activities are the same from weeks 14 to 80.

References: CDOH, 1981; U.S. EPA, 1981; U.S. EPA, 1985.

REVISED KEY TO REVISED TABLE 4.13

Symbol	Definition		Assumed Value
S =	Silt content of soil		15%
m =	Moisture content of soil	- subsoil	12%
K =	Factor for particle size distribution		0.8
V =	Speed of vehicle		30 km/h
w =	No. of wheels	- haul truck	8
		- others	4
W =	Weight of vehicle	- scraper-average	30 T
H =	Height of soil drop		1 m
Y =	Dumping device capacity		7 m^3
u =	Mean wind speed		5 m/s
p =	Number of days with measurable precipitation		126

Revised Table 4.13

EMISSION ESTIMATES OPERATION - SITE F

(1)	(2) Basis of Estimate	(3) Estimated Value	(4) Uncontrolled Emission Rate	(5) Possible Emission Reduction %	(6) Controlled Emission Rate kg/h
Scraper: Removal (small)	0.029 kg/T	0.029 kg/T	1.0 kg/h	1.0	1.0
Scraper: Haul	$9.6\text{x}10^{-6}\ (S)^{1.3}(W)^{2.4}$ kg/VKT	1.1 kg/VKT	1.3 kg/h	0	1.3
Scraper: Discharge	0.02 kg/T	0.02 kg/T	0.7 kg/h	0	0.7
Bulldozers (2)	$\frac{2.6\ (S)^{1.2}}{(m)^{1.3}}$ kg/h	2.65 kg/h	1.3 kg/h	0	1.3
Front End Loader	18 g/m^3	18 g/m^3	0.62 kg/h	25%	0.5
Compactor	4.6 g/s	4.6 g/s	8.3 kg/h	0	8.3
Truck Traffic	$1.7\ K\ \frac{S}{12}\ \frac{V}{48}\ \frac{W}{2.7}^{0.7}\ \frac{w}{4}^{0.5}\ \frac{365-p}{365}$ kg/VKT	0.28 to 1.8 kg/VKT	46.2 kg/h	75%	11.6
Soil Haul to Pile	$1.7\ K\ \frac{S}{12}\ \frac{V}{48}\ \frac{W}{2.7}^{0.7}\ \frac{w}{4}^{0.5}\ \frac{365-p}{365}$ kg/VKT	3.4 kg/VKT	10.5 kg/h	75%	2.6
Soil Drop	$\dfrac{0.73 \times 0.0009\ \frac{S}{5}\ \frac{U}{2.2}\ \frac{H}{1.5}}{\frac{M}{2}^{2}\ \frac{Y}{4.6}^{0.33}}$ kg/T	$7.2\text{x}10^{-5}$ kg/T	<0.1 kg/h	0	<0.1 kg/h
Wind Erosion*	0.85 T/hectare/year	0.085 $kg/m^3/yr$	1.9 kg/h	0	1.9 kg/h

References: CDOH, 1981; U.S. EPA, 1981; U.S. EPA, 1985.

Notes:

* Only occurs when windspeed exceeds 20 km/h.

Revised Table 5.1

IMPACTS ON AIR QUALITY FACTORS FOR SITE F

Air Quality Factor		Impact
Total Suspended Particulate Matter		
. Construction		Some impacts may occur at nearest residences and Bayview Park very briefly when levels are near provincial air quality criteria.
. Operation		Some impacts above provincial air quality criteria (Section 4.2.1.) in Bayview Park. Expected frequency of occurrence is low.
Odour		
. Construction	- no construction related emissions	No impact.
. Operation		No impact at residences. Predicted to be detectable at site boundaries.

Revised Table 5.2

Site F
SUMMARY OF NET ENVIRONMENTAL IMPACTS

Type and Source of Impact	Nil	Low	Medium	High
TSP				
Construction			berm, dyke and valley infill construction may impact nearest residents to the north and the Bayview Park for a very brief time	
Operation		levels may exceed standards very infrequently however the levels can be reduced by mitigative measures.	occasional elevated levels at Bayview Park depending on meteorology.	
Odour				
Construction	no construction related emissions			
Operation			no impact at residences, predicted to be undetectable at site boundaries	

HALTON REGIONAL LANDFILL TECHNICAL STUDY
AIR QUALITY ANALYSIS
REVISED COMPARISON OF
SITE D AND SITE F

by

SENES Consultants Limited
499 McNicoll Avenue
Willowdale, Ontario
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May 1987

REVIEW OF STAGE 2C WORK

Potential air quality impacts associated with landfill operations at six candidate sites were described in the Stage 2C, Technical Report No. 6, Air Quality Assessment (SENES, 1985). Operating procedures, site layout, and the equipment likely to be used were assumed based on current operating practices in the Region of Halton. Air quality impacts were addressed in terms of two parameters, total suspended particulate matter (TSP) and odour.

It was determined that elevated levels of TSP could be observed at the boundaries of any of the six sites, but that the elevated concentrations would occur only during periods of dry weather and high levels of activity near the boundaries of the sites. Odour from any of the sites was described as being not readily detectable except under certain, uncommon, short-lived meteorological conditions.

It was concluded that any of the sites would be acceptable from an air quality perspective. The sites were differentiated only by the proximity of local residences and other receptors. It was also noted that mitigating measures could be used to reduce the emissions and impacts identified in the assessment.

1986 COMPARATIVE ANALYSIS

1.0 Methodology

Subsequent to the 1985 review, further details have become available about the facility layouts and methods of operation that could be used at two of the candidate sites (Site D and Site F). More complete, site-specific information about the existing air quality at each site also has been gathered. The new information has been used to prepare the following comparison between sites of potential air quality impacts.

To prepare the comparison, four basic steps were followed:

1 - Existing air quality was characterized by taking measurements at each site and compiling information gathered by the Ontario Ministry of the Environment (MOE) air quality monitoring network. Meteorological data were obtained from nearby stations operated by the Atmospheric Environment Service of Environment Canada.

2 - Using the most recent descriptions of the layouts and operating procedures for each site, emission rates of TSP and odour were calculated.

3 - The emission rates and meteorological data were used as inputs for an atmospheric dispersion model to generate estimates of TSP and odour concentrations at nearby residences, parks, and other sensitive receptors.

4 - The predicted concentrations of TSP were compared to the criteria listed in Section 3.0 of the air quality analysis prepared for each site. The estimated occurrence of detectable odour was judged on the frequency and severity of occurrence.

2.0 Existing Ambient Air Quality

The existing air quality in the vicinity of each site was examined with respect to TSP, dustfall, and odour. These are the air quality characterisitics that a landfill operation most likely would affect.

The existing TSP levels are similar at the two sites. The geometric means of the TSP data collected to date are 32 ug/m^3 for Site D and 33 ug/m^3 for Site F. The range of TSP concentrations for both sites is approximately 10 to 110 ug/m^3.

The measured dustfall rates are also quite similar at both sites. The mean levels are 1.8 $g/m^2/30$ days near Site D and 2.8 $g/m^2/30$ days near Site F. The rates range from 0.1 to 12.5 $g/m^2/30$ days at both sites.

The TSP and dustfall data for both sites fall within the ranges found at normal rural locations. Annual averages are below the MOE criteria, but short-term fluctuations likely result in occasional exceedences of the monthly dustfall or 24-hour TSP criteria.

Background odour measurements are not routinely made by the MOE because of difficulties in evaluating the quantity and quality of an odour. During visits to Site D in 1985 and 1986, no sources of odour other than those routinely associated with agricultural operations, were noted. A landfill is currently being operated adjacent to Site F. During visits to the area in 1985 and 1986, odours were not detected. No odour complaints have been lodged with the MOE in regard to this landfill. Accordingly, existing odour levels at both sites are judged to be acceptable.

what about litter? complaints

3.0 Meteorology and Climatology

Temperature and precipitation data support the assumption that the two sites have similar climatological characteristics.

The potential air quality impacts arising from a landfill being constructed at either site would be influenced by wind and atmospheric stability. Two sets of conditions can be used to differentiate between sites. One is the frequency of higher wind speeds (more than 5 m/s) which can enhance atmospheric dispersion but also enhance the erosion of unvegetated soil and the pickup and transport of litter. Such wind speeds are associated with atmospheric stability classes C and D. The other set of conditions includes the frequency of relatively low wind speeds (less than 2 m/s) with classes E and F atmospheric stability. Under these conditions, dispersion is inhibited and concentrations of emissions will remain detectable for longer distances before being dispersed to non-detectable levels. Both conditions have advantages and disadvantages from an air quality perspective and neither is preferred. In general it can be said that Site D is windier (wind speed exceeds 5 m/s 27.4% of the time compared to 14.9% at Site F), but Site F has more stable, low-wind speed conditions (16.2% of the time compared to 11.4% at Site D).

4.0 Predicted Emissions

The total predicted TSP emissions for the two sites are summarized below:

	Site D	Site F
Construction	180 kg/h	49.3 - 67.1 kg/h
Operation	29.2 kg/h	29.2 kg/h

Estimated emissions of TSP during operation are the same for both sites. The difference between sites during construction reflects differences in the size and location of berms and stockpiles.

Because odours would only be emitted during operation of the landfill and the proposed operating procedures are the same for both sites, the odour emissions are assumed to be the same.

5.0 Predicted Impacts

At Site D, during the two months that construction of the berm is expected to take, there will be occasional occurrences of elevated TSP levels at the residences on First Line. These TSP levels will be similar to those experienced near any large construction project.

During the operation of Site D, the highest point-of-impingement TSP concentration at a nearby residence is estimated to be 53 ug/m^3. This is well below the MOE point-of-impingement criterion of 100 ug/m^3. The long-term annual average TSP level attributable to the landfill is predicted to be 10 ug/m^3.

At Site F, during the two years that the construction of the berms and stockpiles is expected to take, there will be occasional occurrences of elevated TSP levels in Bayview Park and near the residences to the north. These TSP levels will be similar to those experienced near any large construction project.

During operations at Site F, maximum point-of-impingement TSP levels in the Bayview Park area are estimated to be about 140 to 200 $\mu g/m^3$. The maximum point-of impingement concentrations at the nearest residences are estimated to be less than 40 $\mu g/m^3$. The long term TSP levels attributable to the operation of the landfill will be about 12 $\mu g/m^3$.

ie NOT standard exceeded.

No off-site occurrences of detectable odour are predicted for either Site D or Site F, except for a slight potential for the detection of odours at the property line between Site F and Bayview Park and on the existing Regional Landfill site in Burlington.

6.0 Recommended Mitigation Measures

In estimating the emissions of TSP, it was assumed that the following mitigation measures would be in practice:

assumptions

1 - all permanent roads within the landfill site would be paved;
2 - all dust and gravel roads within the landfill would be watered regularly during dry weather;
3 - all areas of exposed soil would be revegetated as soon as possible.

The normal operating practice of covering the raw refuse at the end of each day is considered to be an adequate mitigative measure for odour emisssions.

7.0 Conclusions and Recommendations

The predicted air quality impacts presented in this analysis are less than those presented in the Stage 2C report. This is largely attributable to the relatively vague descriptions of the landfill layouts and operating procedures that were available at the time of preperation of the Stage 2C report. This required that relatively crude assumptions be made concerning emission rates. The information now available about proposed operating procedures and mitigation measures enable more realistic emission rates to be estimated and better, more confident predictions of air quality impacts to be made.

Except for the brief construction period early in the life of both sites, either site is acceptable from an air quality perspective. The air quality impacts of Site D are summarized in Table 5.1 and those of Site F are in Table 5.2. All of the comparative factors are summarized on Table 5.3.

Revised Table 5.1

SITE D - AIR QUALITY IMPACTS SUMMARY

Type and Source of Impact	Nil	Low	Medium	High
TSP				
Construction				berm construction impacts at residences on First Line for short periods
Operation			occasionally elevated levels depending on meteorology	
Odour				
Construction	no construction related emissions			
Operation			predicted to be undetectable at site boundaries	

Notes

- nil - no emission and no possible impact
- low - TSP or odour emissions are present but no exceedances of MOE air quality criteria are predicted
- medium - TSP or odour emissions are present but no exceedances of MOE air quality criteria are predicted at residences; some exceedances (10% or less of the time) are possible at site boundaries depending on the meteorology
- high - predicted TSP or odour concentrations are likely to exceed MOE air quality criteria more than half the time

Revised Table 5.2

SITE F - AIR QUALITY IMPACTS SUMMARY

Type and Source of Impact	Nil	Low	Level of Impact Medium	High
TSP				
Construction			~~berm, dyke and valley infill construction may impact~~ nearest residents to the north and the Bayview Park for ~~a very brief time~~	
Operation		levels may exceed standards very infrequently however the levels can be reduced by mitigative measures.	occasional elevated levels at Bayview Park depending on meteorology.	
Odour				
Construction	no construction related emissions			
Operation			no impact at residences, predicted to be undetectable at site boundaries	

Notes

- nil - no emission and no possible impact
- low - TSP or odour emissions are present but no exceedances of MOE air quality criteria are predicted
- medium - TSP or odour emissions are present but no exceedances of MOE air quality criteria are predicted at residences; some exceedances (10% or less of the time) are possible at site boundaries depending on the meteorology

Revised Table 5.3

NET AIR QUALITY EFFECTS WITH MITIGATIVE MEASURES IN PLACE

Impact	Site D	Site F
Construction		
TSP	berm construction impacts at residences on First Line for a short period of time.	berm, dyke and valley infill construction may impact nearest residents to the north and the Bayview Park for a very brief time.
Odour	not applicable	not applicable
Operation		
TSP	occasional levels in excess of criteria at site boundaries depending on	no levels in excess of criteria at residences after mitigation, some levels in excess of criteria at site boundaries
	meteorology.	at site boundaries
Odour	undetectable at site boundaries.	no impact at residences, undetectable at site boundaries.

Mitigation Measures

TSP
- all permanent roads within the landfill are paved
- all dirt and gravel roads within the landfill are wetted in periods of dry weather
- all exposed soil revegetated as soon as possible

Odour - normal practice of properly covering garbage at the end of each day